

**WHAT IS CLAIMED IS:**

1. A process for the production of a thin film porous ceramic-metal composite, comprising

5           - contacting a substrate with a solution comprising precursor compounds of ceramic, stabilising chemical moiety, and metal, so as to form a precursor coating directly on the substrate,

              - thermally treating said substrate with the coating at a temperature sufficient to decompose said precursor compounds to form a thin film of stabilised porous  
10 ceramic strongly adhered directly to the substrate, the ceramic being in a suitable crystalline form such as zirconia in the cubic phase, incorporating therein or thereon said one or more metals or metal oxides.

2. The process of claim 1, wherein at least one solution is dissolved in at least one other solution.

15       3. The process of claim 1, wherein said substrate comprises metal or metals, or alloys, such as steel containing iron, chromium and aluminium.

4. The process of claim 1, wherein said substrate comprises a knitted wire monolith, such as in the form of a sheet-like material or a roll.

20       5. The process of claim 1, wherein said substrate comprises silicon, polymers, such as polyimide, and glass.

6. The process of claim 1, wherein said heating is carried out at a temperature in the range from about 350°C to about 1000°C, preferably 400°C for a period between about 10 seconds to about 10 minutes.

25       7. The process of claim 1, wherein said zirconia precursor is an organic compound of zirconia, such as zirconium substituted or unsubstituted C<sub>1</sub>-C<sub>8</sub> alkyl carboxylate, such as propionate.

8. The process of claim 1, wherein said stabilising moiety precursor is an organic compound of yttrium or cerium, such as yttrium substituted or unsubstituted C<sub>1</sub>-C<sub>8</sub> alkyl carboxylate, such as yttrium 2-ethylhexanoate.

9. A composite comprising:

- a thin film porous ceramic layer coated on a substrate, the porous ceramic layer being in a suitable crystalline form such as zirconia in a cubic phase stabilised by a chemical moiety, wherein the ceramic layer is strongly adhered directly to the substrate, and

- a metal incorporated in or on the ceramic layer.

10. The thin film composite according to claim 9, wherein the substrate is a metal wire, such as a knitted wire material or a knitted wire rolled material.

11. The thin film composite of claim 9, wherein the porous ceramic layer is a zirconia stabilised by yttria.

12. A catalytic element comprising:

- a thin film porous ceramic layer coated on a metal substrate, the porous ceramic layer being in a suitable crystalline form such as zirconia in the cubic phase, stabilised by a chemical moiety, wherein the ceramic layer is strongly adhered directly to the substrate, and

- a catalytic metal incorporated in or on the ceramic layer.

13. The catalytic element according to claim 12, wherein the substrate is a knitted metallic wire or wires.

14. The catalytic element of claim 12, wherein the catalytic metal is palladium in a concentration from about 0,5% by weight to about 5% by weight to the weight of ceramic layer.

15. A thin film gas sensor comprising:

- a thin film porous ceramic layer coated on a substrate, the porous ceramic layer being in a suitable crystalline form such as zirconia in the cubic phase stabilised by a chemical moiety, wherein the ceramic layer is strongly adhered directly to the substrate, and

- a metal incorporated in or on the ceramic layer.

16. The thin film gas sensor according to claim 15, wherein the gas sensor has sensitivity with respect to C<sub>1</sub>-C<sub>18</sub> hydrocarbons, such as propane, butane, etc.

17. A process for the production of a thin film metal plated ceramic-metal composite, comprising the steps of:

- contacting a substrate with a solution to form a coating directly on the substrate, the coating comprising precursors of ceramic, such as zirconia, stabilising chemical moiety, and metal,

- thermally treating said coated substrate at a temperature sufficient to decompose said precursor compounds to form a porous ceramic layer of stabilised ceramic, such as zirconia, adhered directly to the substrate by strong bonding, the ceramic, such as zirconia being in a suitable crystalline form such as the cubic phase incorporating therein or thereon said one or more metals or metal oxides; and

- subjecting the substrate having the ceramic layer thereon to a plating process in conditions to provide incorporated in or on the ceramic layer dispersed metal particles acting as nuclei onto which the metal of the plating process is deposited.

18. A process of claim 17, wherein the ceramic layer is patterned before subjecting to metal plating.

19. A thin film metal plated composite comprising:

- a thin film porous ceramic layer coated on a substrate, wherein the porous ceramic layer, such as zirconia, is adhered directly to the substrate by strong bonding, wherein the ceramic is in a suitable crystalline form such as the cubic phase stabilised by a chemical moiety and incorporating one or more metals or metal oxides therein or thereon, and

- a metal film plated upon the ceramic layer.

20. A thin film metal plated composite of claim 19, wherein the metal plated is nickel.